



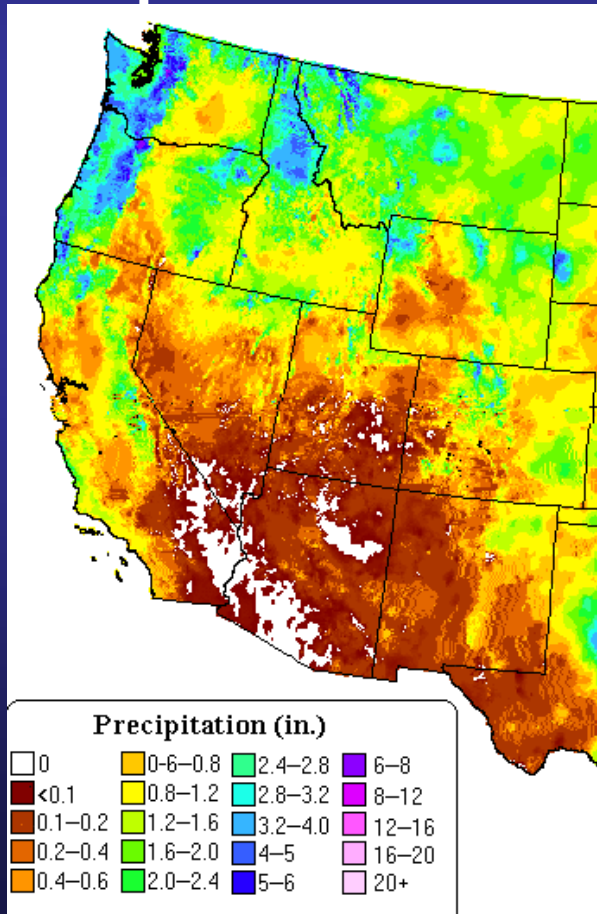
## **Project team:**

- **Arizona- Craig Rasmussen**
- **California- Bob Graham, Randy Dahlgren, Ben Houlton, Toby O'Geen, Mike Singer & Randy Southard**
- **Colorado-Keith Paustain?**
- **Idaho-Paul McDaniel**
- **Nevada-Brenda Buck**
- **New Mexico-Curtis Monger**
- **Oregon-Jay Noller and Ron Reuter**
- **Utah-Janis Boettinger**
- **Washington-Bruce Frazier**
- **Wyoming-Jay Norton**

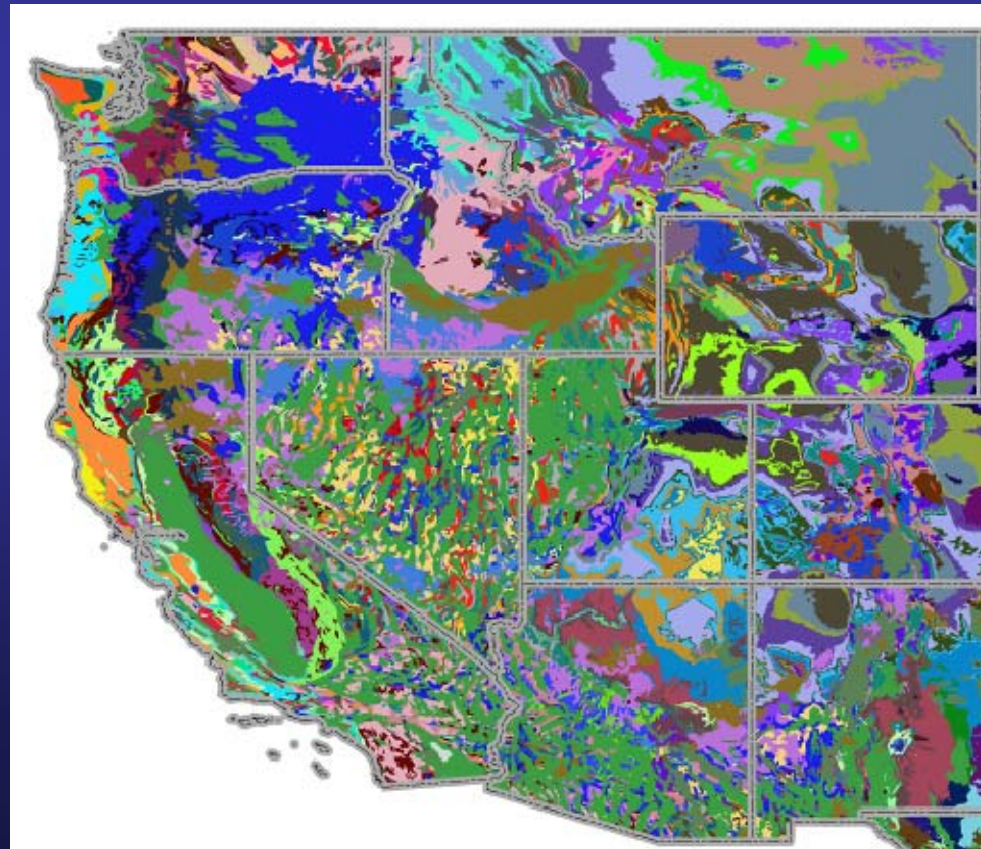
# Objective 1

Study the impacts of climate change on soil processes in benchmark soilscares located across regional bioclimatic sequences in the west

## Precipitation in March



## Geology of Western US



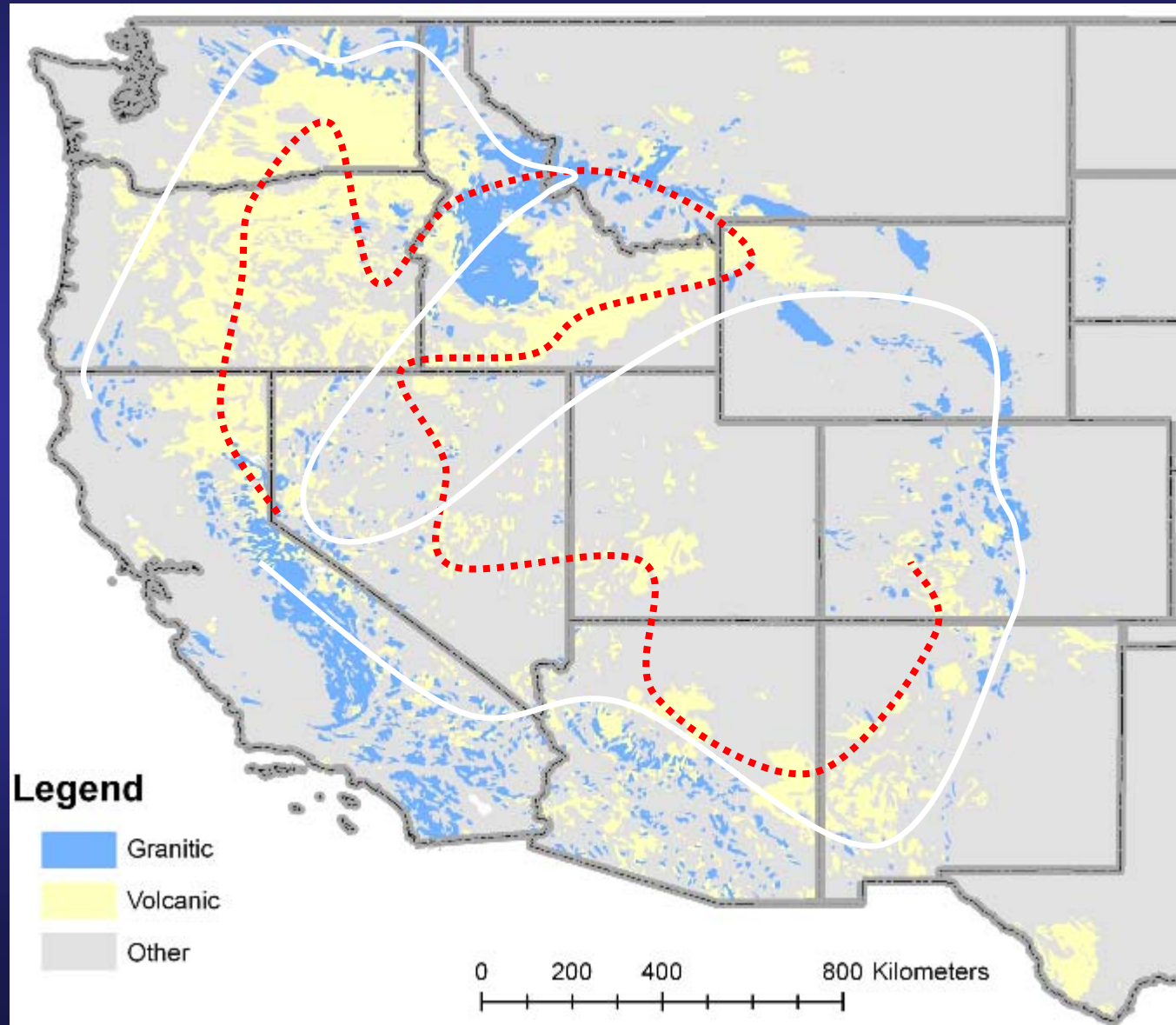
# Bioclimatic sequences of benchmark soilscapes in the west

..... Transported  
materials

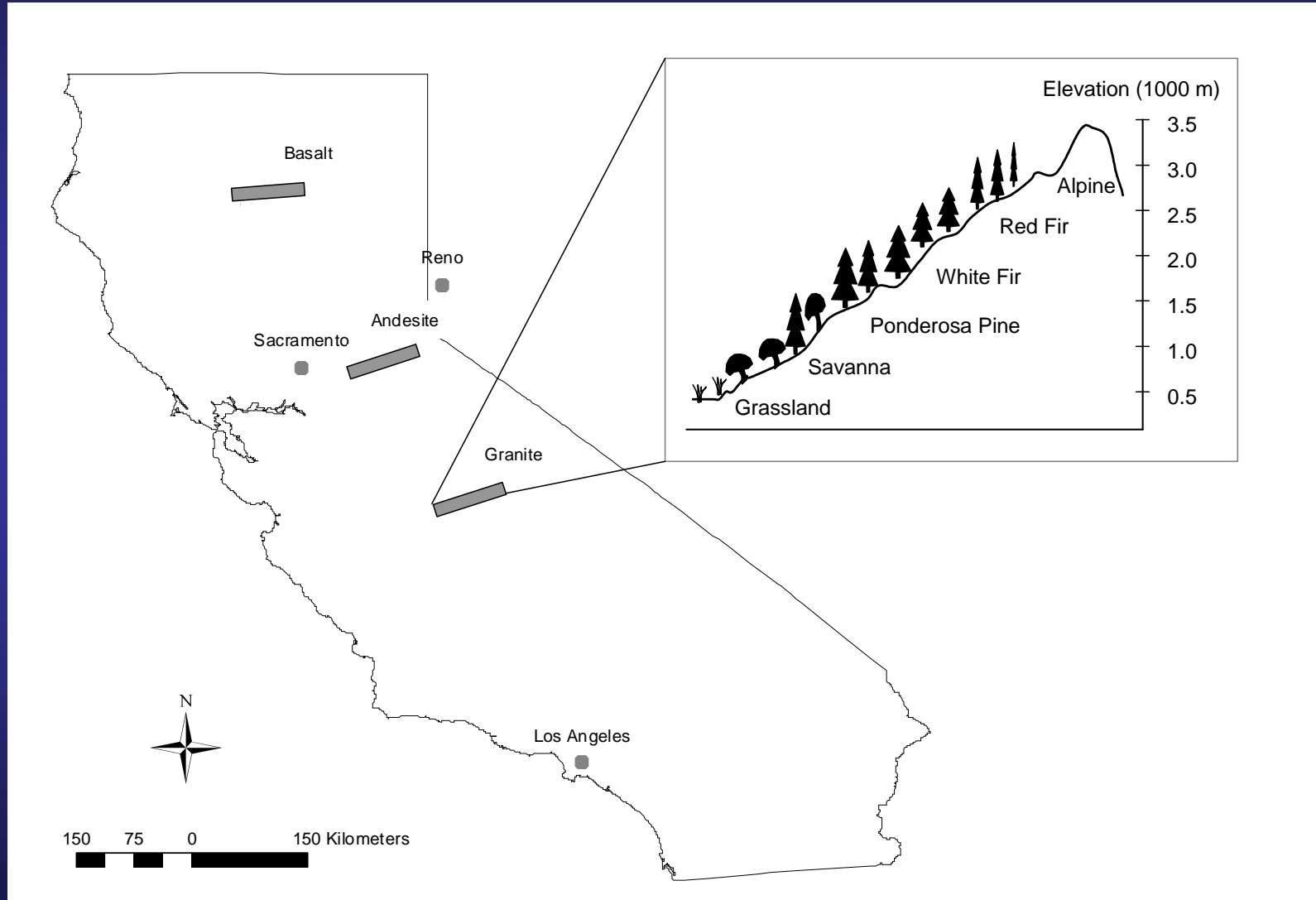
— Granite

Transects spanning:

Hyperthermic - Cryic  
&  
Aridic - Aquic



# Example of a developmental sequence within the regional project





# Objective 2

- Characterize biogeochemical, mineralogical, physical and morphological properties of soils through the National Soil Survey Laboratory



- Field support from regional offices



- Soil Survey Laboratory support for lab analysis

# Laboratory Characterization

CEC

B.S.%

Total N

SOC

Active C

pH

EC

Extractable Fe, Mn, Al, Si

XRD

PSA

CaCO<sub>3</sub>

Bulk density

Available water

Ksat

Available P

Opportunities to compare dynamic soil properties

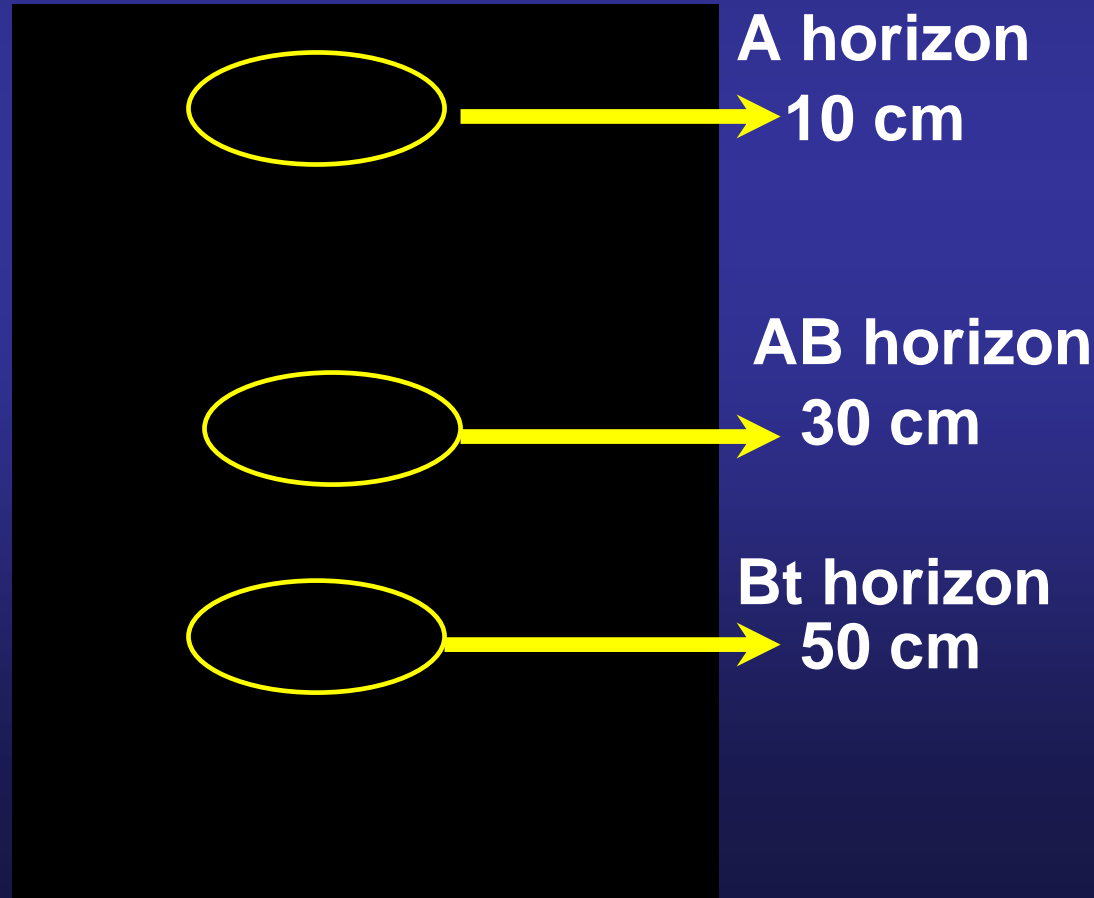
# Objective 3

- Monitor soil temperature and soil moisture (primary climatic drivers of pedogenesis).



Soil moisture: Decagon EC-5 probe with em5b datalogger

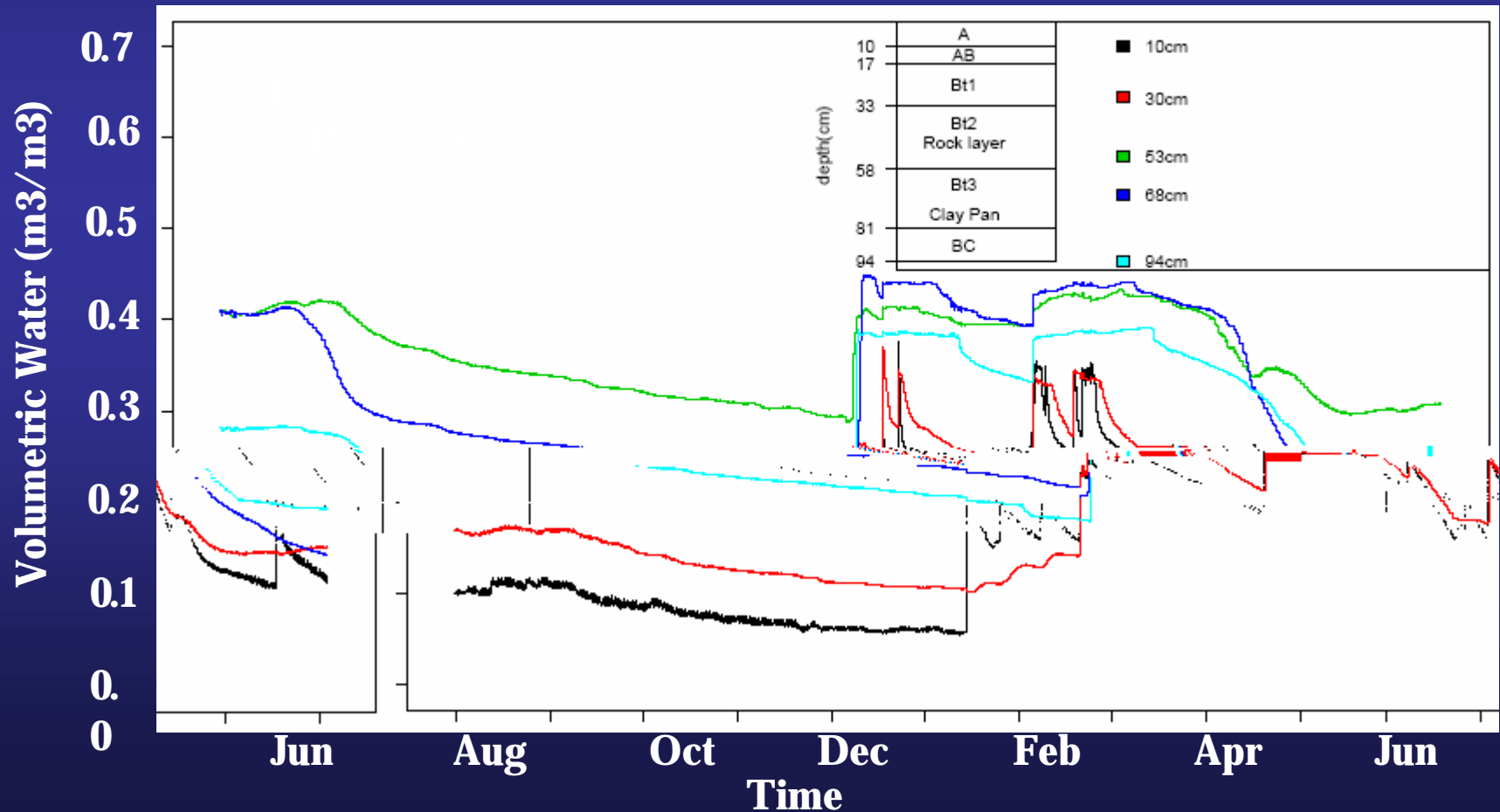
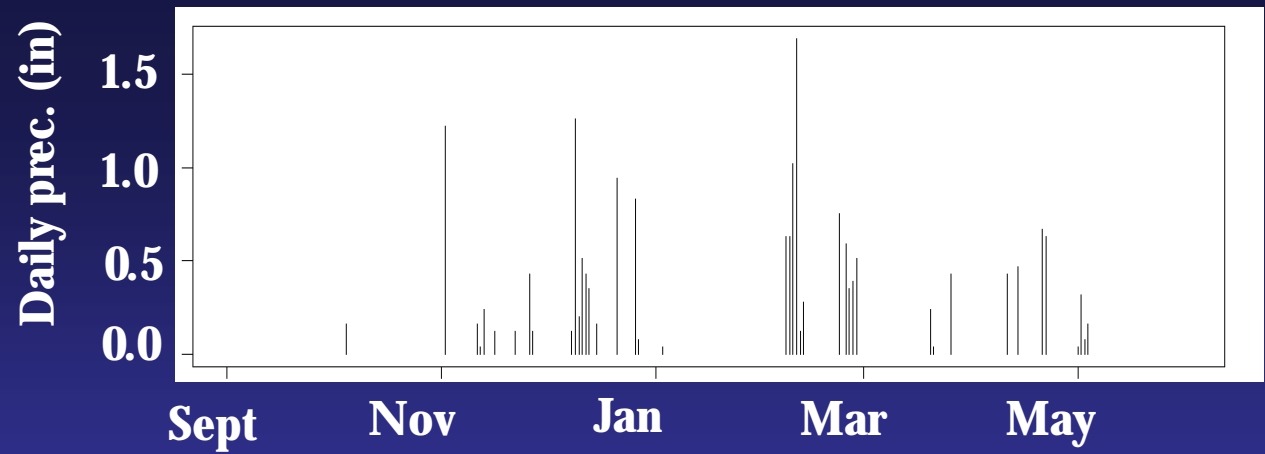
Soil temp.: Decagon ECT probe at 10 and 50 cm





# Temporal moisture distribution

duration at saturation, field capacity and soil moisture deficit.



# Objective 4

- **Conduct experiments that quantify the impacts of climate on ecosystem services governed by soil forming processes:**

## Soil Forming Processes

**Weathering & secondary mineral formation**

**Organic matter accumulation/decomposition**

**Soil water relationships**

## Ecosystem Services

**Nutrient cycling**

**Carbon storage**

**Regulation of quantity and quality of water supply**

# Weathering intensity, lithium feldspar decomposition

Ion exchange resin zero tension lysimeter at 30 cm depth

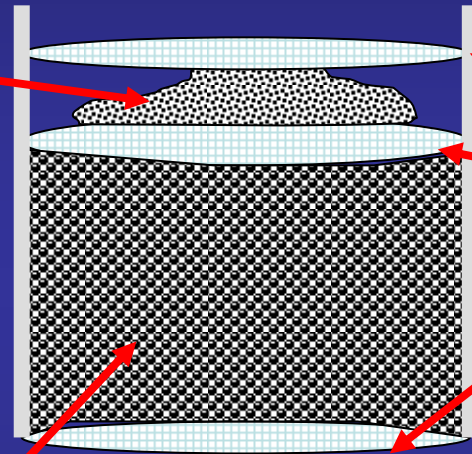
Lithium Feldspar

*Fine sand size*

*Petalite (lithium feldspathoid) Quartz, na-feldspar, Rb-K feldspar*

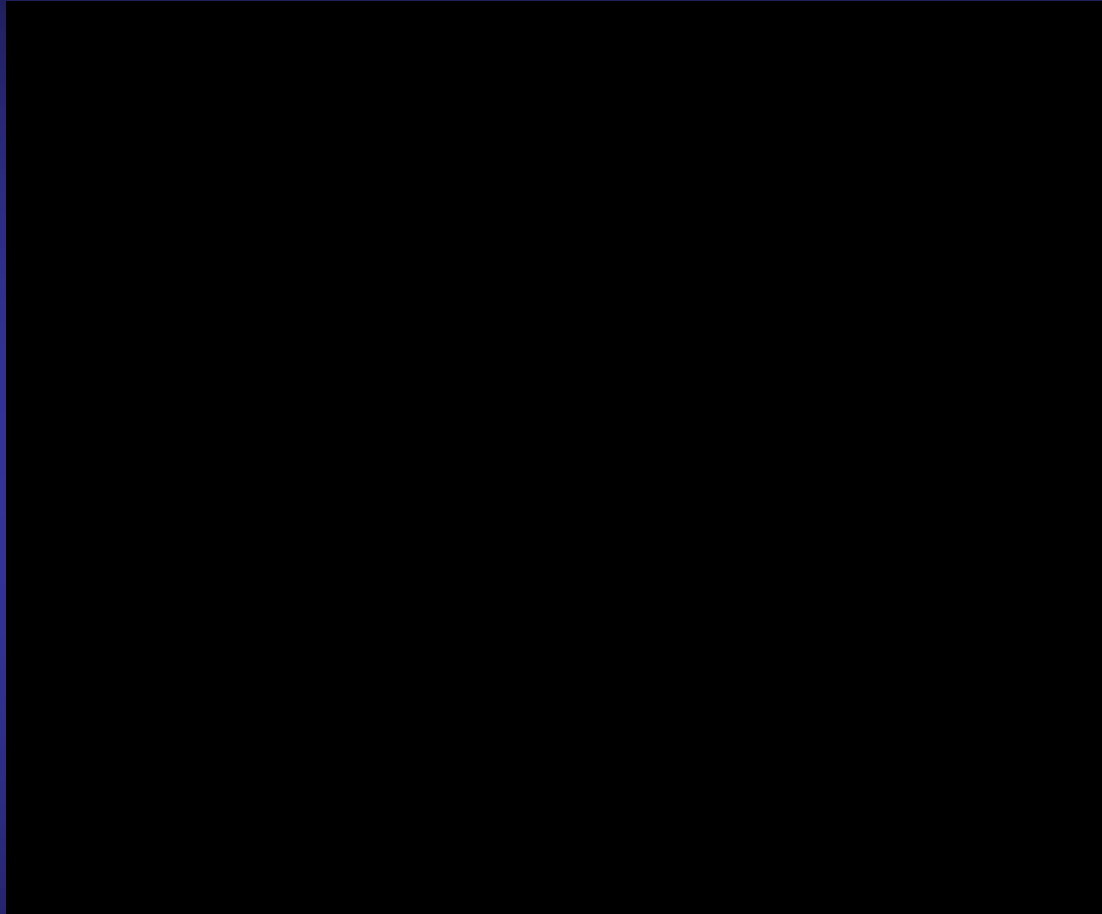
Cation and anion exchange resins

Stainless steel mesh (45  $\mu\text{m}$ )



8 people x 2 sites x 3 reps x 1 depth =  
48 lysimeters with feldspar and 48 with  
quartz sand

# Organic matter accumulation/decomposition



**8 people x 3 reps/yr x 3 sites x 4 years = 288 bags  
containing 15 -20 g of ponderosa pine litter**



Hillslopes 2-40%

Elevation 67 to 615 m

Oak woodland (blue oak,  
interior live oak, foothill pine  
and annual grasses)

## Northern California Sierra Foothills -Toby O'Geen

thermic/xeric: MAP 711 mm, MAT 16 °C

mean summer temp 32 °C

mean winter 2.7 to 6 °C

metavolcanic colluvium and residuum

Fine, mixed, superactive, thermic  
Mollic Haploxeralfs (Argonaut)

*100 soil profiles with soil moisture sensors*

A

AB1

BA

Bt1

Bt2

Cr

Hillslopes 2-30%

Elevation 210 to 520 m

Oak woodland (blue oak,  
interior live oak, foothill  
pine and annual grasses)

## Southern California Sierra Foothills-Toby O'Geen

granitic colluvium and residuum

thermic/xeric MAP 486 mm

mean summer temp 24-27 °C

mean winter temp. 4-10 °C

Coarse-loamy, mixed, active, thermic  
Mollic Haploxeralfs (Ahwahnee)

*15 profiles \ (summit, sideslopes, N vs S, valley, and  
canopy or no canopy*

A

AB

Bt

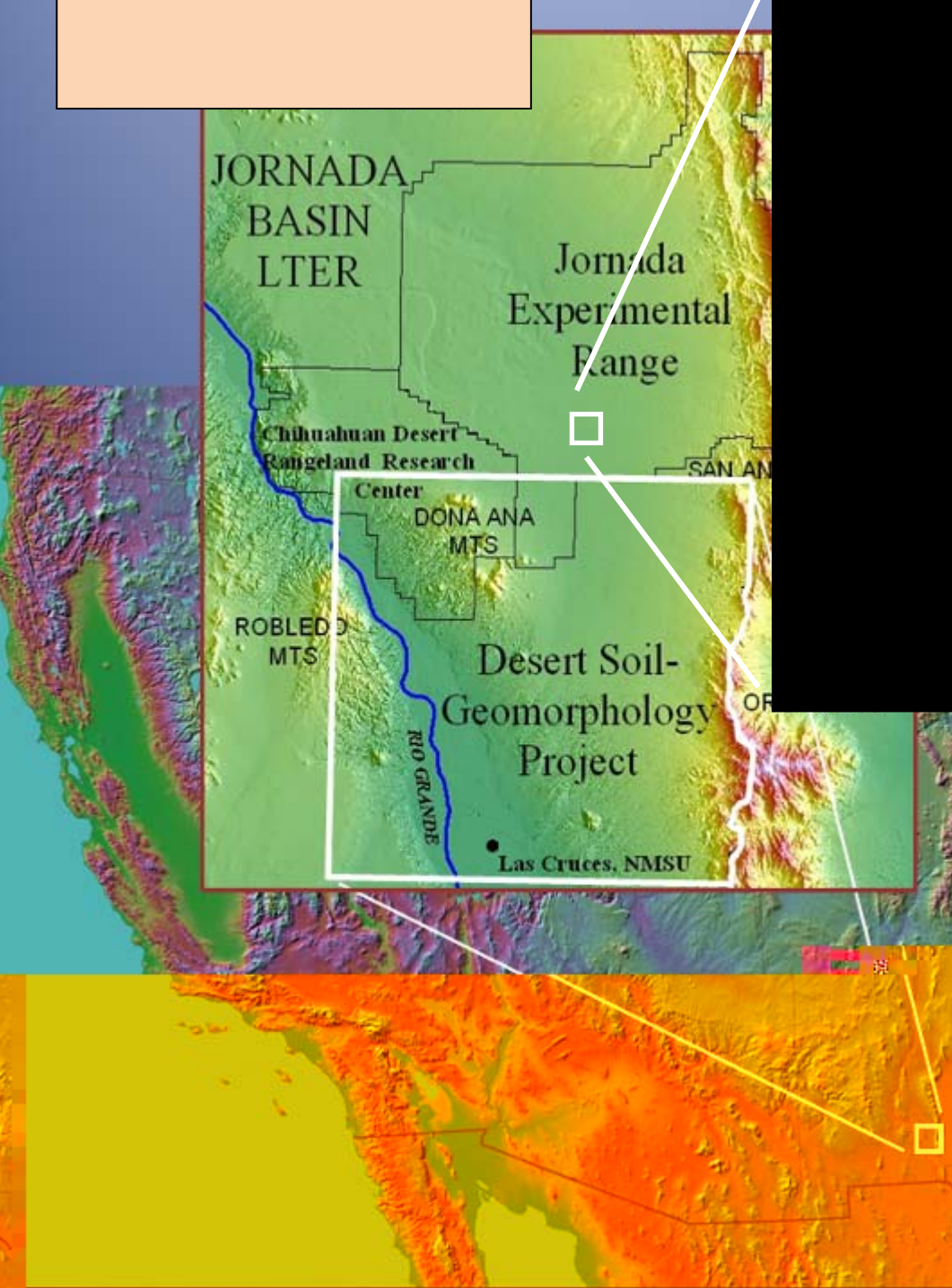
Cr



# **University of California - Riverside**

## **R.C. Graham**

- **White Mountains, California**
- **elevational transect: 5,000 - 14,000 ft.**
  - **USGS/UCSD climate stations every 1,000 ft.**
- **granitic bedrock**
- **shadscale - big sagebrush - pinyon/juniper -  
limber pine - alpine grasslands**
- **aridic - ustic (?); mesic - cryic**
- **Torriorthents - Camborthids - Cryepts - Cryolls**



Curtis Monger

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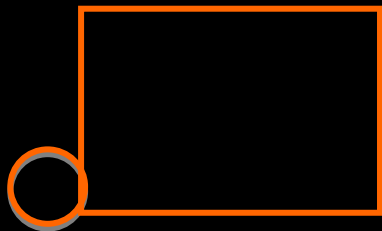
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# Medicine Bow National Forest, WY

Jay Norton

Two transects, granite / quartz monzonite & quartzite

- Elevation range: ~2500 to 3600 m
- Temperature (°C): Frigid/Cryic -15 to 25
- Moisture is snowfall dominant: Udic ~1300 to 4500 mm as snow
- Soils: Typic Dystrocryepts, Typic Haplocryalfs, Humic Dystrocryepts
- Vegetation: Lodgepole pine dominant  
Limberpine, Subalpine fir, Englemann spruce, and Rocky Mountain alpine tundra spp. at highest elevations



**Mountain slopes**  
**2-35%**

**1600-400 ft elev.**  
**(635-1270 m)**

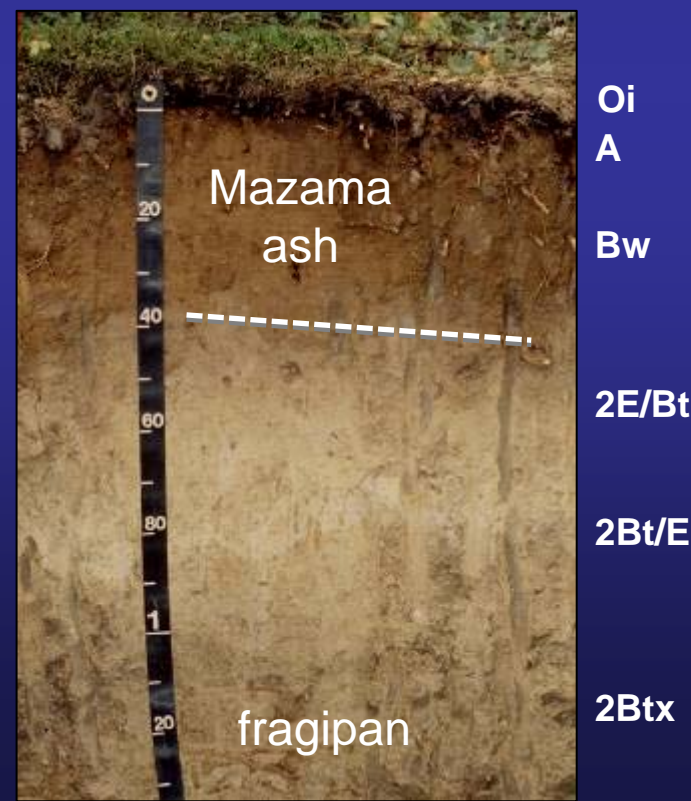
**western redcedar,  
Douglas-fir, grand fir,  
western larch,  
western white pine**

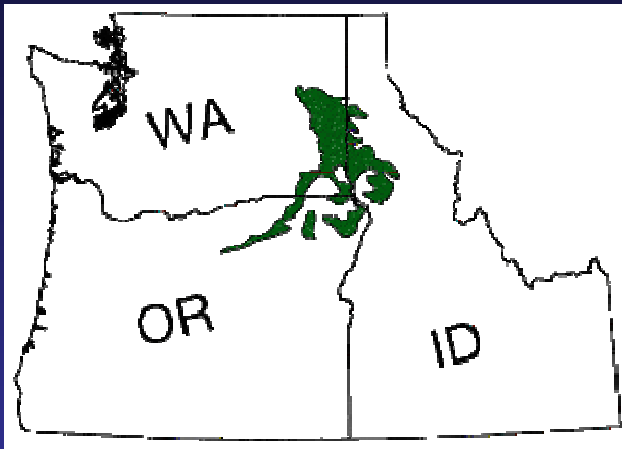
**Paul McDaniel**

**Udic SMR (635-1270 mm MAP)**  
**Frigid STR (3-7 °C)**

**Thick Mazama ash mantle over  
loess/reworked loess**

**Alfic Udivitrands (Threebear series)**





## Palouse Landscape



**Washington-Bruce Frazier**

**Palouse Loess deposits**

**Mesic/Xeric**

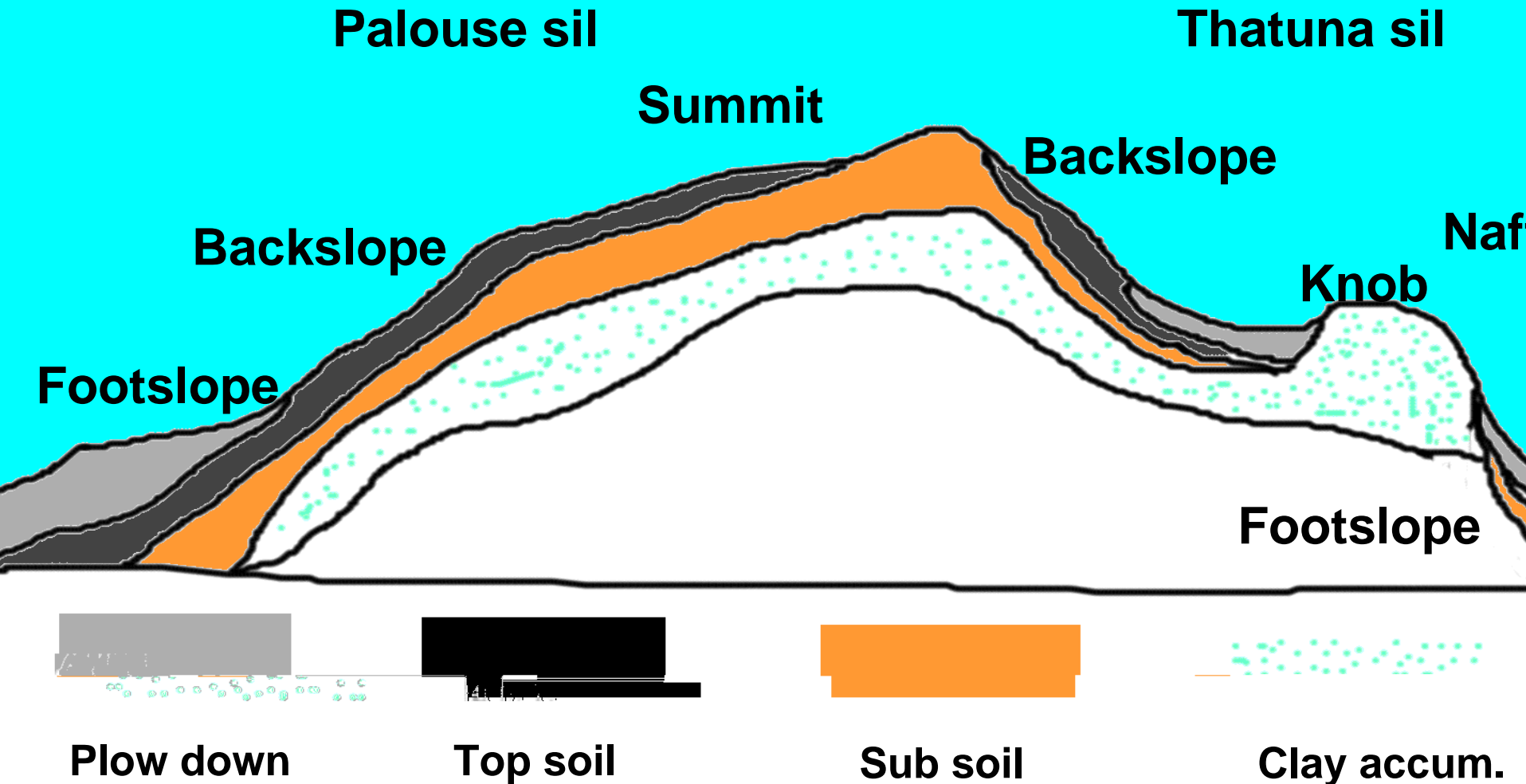
**MAP = 400 mm**

**MAT = 10 °C**

**Native veg. bunchgrass steppe**  
**Blue bunch wheatgrass**



# Palouse Loess Stratigraphy





# **Oregon-Jay Noller and Ron Reuter**

## **1. Mazama Pumice-Blanketed Soilscape**

**Pumiceous tephra ejected from Mt. Mazama which aprons hundreds of square kilometers east and north of Crater Lake, Oregon**

**MAP 50-20 inches and MAT ~ 35-45 F**

## **2. Willamette Valley Soilscape**

**Chronosequence of fluvial terraces,  
Willamette Valley**

**Mesic: 8-13 °C Xeric-Udic: 890-1525 mm**

# **Arizona-Craig Rasmussen**

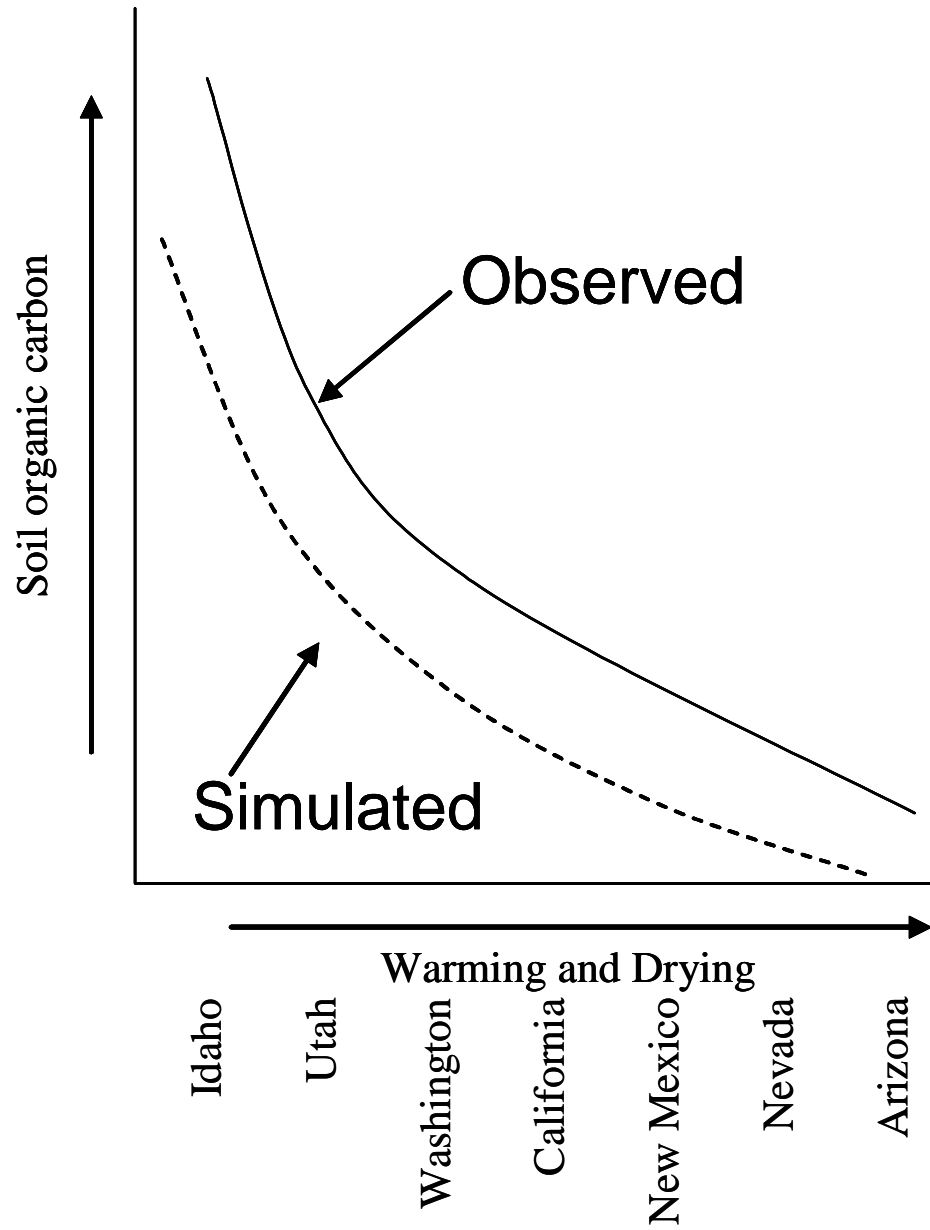
**Sonoran Desert benchmark soil landscape,  
Saguaro National Park (SNP), east of Tucson,  
Arizona**

**Granitic parent material 800-2650 m in elevation**

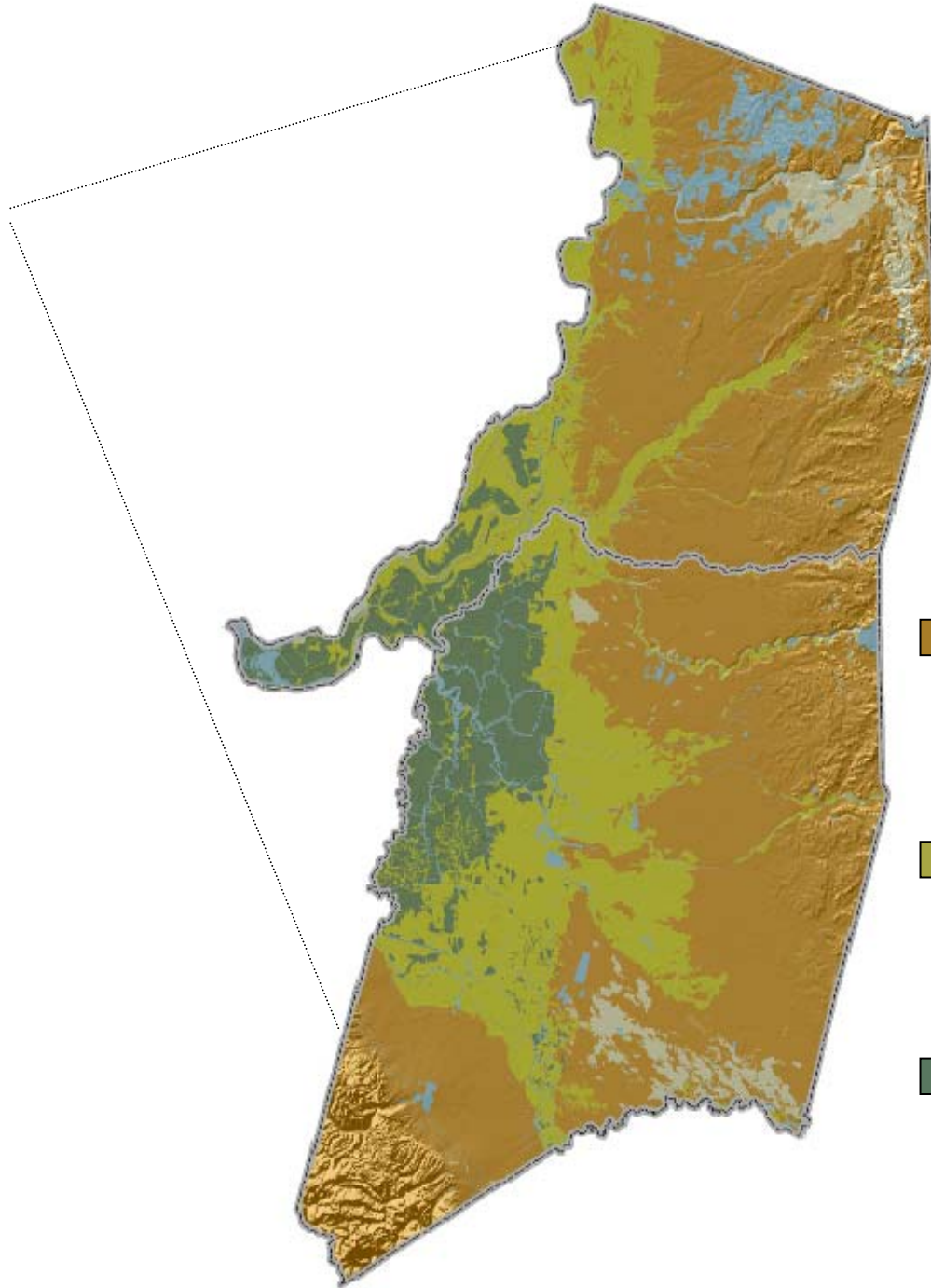
**MAT 10-20 C and MAP 300-800 mm**

**Mixed desert-scrub (<1200m); mixed grass  
and oak woodland (1200-1700m); pinyon-  
juniper woodland (1700-2000m); ponderosa  
pine and fir forest (<2000m)**

# Thank You



# What is a benchmark soilscape?



- Old dissected terraces  
and alluvial fans  
*(Redding, San Joaquin, Corning)*
- Recent alluvium and basin  
rim deposits *(Tokay,  
Columbia, Kingdon)*
- Smectitic Basin Alluvium  
Stockton, Capay

# Perched water collection system

Perched water is collected from four soil horizons in three soil profiles. Water is routed to tipping buckets for flow measurement and stored in containers for water quality analysis.

